

WHAT IS CLAIMED IS:

1. In a watercraft drive for a watercraft having a hull, said watercraft drive having, drive means including a motor having at least one drive shaft, front and rear propellers respectively mounted on said drive shaft in coaxial longitudinally displaced relationship, each of said propellers having at least two blades, said front and rear propellers having equal diameters and being driven at like rotational velocities, control means disposed between said front and rear propellers, for increasing the energy of a jet of water exiting the front propeller as said jet is transmitted to the rear propeller, said control means causing the water jet leaving the front propeller with both circular and axial flow components to reach the rear propeller substantially without circular components, said control means comprising, a hollow shaft having an upper end connected to said hull, and a lower end, a gondola-shaped underwater housing mounted on the lower end of said hollow shaft and containing said drive means, said drive shafts extending from opposite ends of said housing, and a plurality of guide blades connected to at least one of said hollow shaft and gondola-shaped underwater housing, power means mounted in said hull for transmitting power through said hollow shaft to said drive means for rotating said front and rear propellers, said motor having a rotor covered by a motor housing, and said motor housing being connected, in heat conducting relationship to the inside wall of said underwater housing, whereby heat from said motor is transferred to water surrounding said shaft and said underwater housing, the improvement comprising, the central portion of said rear propeller up to a diameter equal to the diameter of the water jet arriving at the rear propeller, which due to the action of the front propeller has a contracted cross section, is designed to optimize the jet energy exiting the front propeller, said rear propeller further having an annular area extending from said central portion to the outer circumference of the rear propeller, being designed with the same design as characterizes the front propeller, said annular area of the rear propeller receiving a flow of surrounding ambient water.

2. A watercraft drive in accordance with claim 1, wherein the pitch of the blades in the core area of the rear propeller is 1.04 to 1.52 times the pitch of the blades in the core area of the front propeller.
3. A watercraft drive in accordance with claim 2, wherein the pitch of the blades in the annular area of the front propeller is between 95 percent and 105 percent of the pitch of the blades in the annular area of the rear propeller.
4. A watercraft drive in accordance with claim 2 wherein the pitches of the blades of each of the front and rear propellers is in the range of 0.9 to 1.6.
5. A watercraft drive in accordance with claim 2 wherein the blades of the front and rear propellers have different degrees of arcing.
6. A watercraft drive in accordance with claim 1 wherein said guide blades which have an arc length ratio in the range of 0.0 to 0.2 and an angle of incidence in the range of -7 to +7.
7. A watercraft drive in accordance with claim 6, wherein the control device has two guide blades which are angularly symmetrically disposed about the common axis of rotation of the front and rear propellers.
8. A watercraft drive in accordance with claim 1 wherein the drive means further comprises a transmission, said drive shafts extending from opposite ends thereof, and a connection shaft extending from said transmission through said hollow shaft into said hull for connection to an engine disposed therein.
9. A watercraft drive in accordance with claim 1 further comprising a plurality of electrical conductors extending from said motor through said hollow shaft into said hull for connection to a source of electrical power therein.
10. A watercraft drive in accordance with claim 1 wherein said motor comprises a hydraulic engine operatively connected to hydraulic fluid lines extending through said hollow shaft into said hull for connection to a source of hydraulic power.
11. A watercraft drive in accordance with claim 1 further comprising an accelerating nozzle jacketing the front propeller, said accelerating nozzle having a cross section which tapers from an inlet end upstream of the front propeller to a plane of rotation of the front propeller.

12. A watercraft drive in accordance with claim 1 wherein each of said front and rear propellers is jacketed by a decelerating nozzle having a cross section which increases from a respective nozzle inlet to a plane of rotation of the respective propeller.
13. A watercraft drive in accordance with claim 1, wherein the upper end of the hollow shaft is rotatably mounted on the hull for enabling rotation of the underwater housing relative to the hull.
14. A watercraft drive in accordance with claim 13, wherein the hollow shaft is rotatable about a longitudinal axis relative to the hull by 360 degrees.
15. A watercraft drive in accordance with claim 1 further comprising a front hub for fastening the front propeller to its respective drive shaft and a rear hub for fastening the rear propeller to its respective drive shaft, the front hub and rear hub being contoured for enhancing flow from the front propeller to the rear propeller.
16. A watercraft drive in accordance with claim 1 wherein the motor is a permanently excited synchronous electric motor.
17. A watercraft drive in accordance with claim 16 further comprising clutch means for connecting said driving shafts to said rotor, said driving shafts passing concentrically through the rotor and extending from both ends of the rotor for receiving the propellers which rotate in unison with said driving shaft.
18. A watercraft drive in accordance with claim 17 further comprising bearing means operatively mounted between said housing and said rotor.
19. A watercraft drive in accordance with claim 15 further comprising rotor support tube means for coupling said drive shaft and said rotor.
20. A watercraft drive in accordance with claim 17 wherein the axis of the hollow shaft intersects and is orthogonal to the axis of the drive shaft, and further comprising a carrier cone to which the upper end of the hollow shaft is connected, the housing being continuously pivotable by 360 degrees around the longitudinal axis of the hollow shaft.
21. A watercraft drive in accordance with claim 20, wherein the hollow shaft and the carrier cone are mutually detachably connected in a plane of the hull.
22. A watercraft drive in accordance with claim 20 wherein the carrier cone has a large end and a small end having a smaller cross section than said large end, the

hollow shaft being connected to the small end of the carrier cone and the large end of the carrier cone being connected to the watercraft within the hull.

23. A watercraft drive in accordance with claim 7 wherein the hollow shaft comprises one of said guide blades that are rotationally symmetrical disposed about the common axis of rotation of the front and rear propellers.

24. A watercraft drive in accordance with claim 1 wherein the front propeller is jacketed by a decelerating nozzle having an inlet and a cross section which increases from the inlet to the plane of rotation of the propeller.

25. A watercraft drive in accordance with claim 1 wherein each of the front and rear propeller is jacketed by one of an accelerating nozzle having an inlet and a cross section that decreases with distance from its inlet to the plane of rotation of its respective propeller, and a decelerating nozzle having an inlet and a cross section that increases from its inlet to the plane of rotation of its respective propeller.

26. A watercraft drive in accordance with claim 1 wherein each of the front and rear propellers is surrounded either one of an accelerating nozzle having an inlet and a cross section decreasing with distance from the inlet of the nozzle toward the plane of rotation of the first propeller, and a decelerating nozzle having a cross section increasing with distance from the inlet of the nozzle toward the plane of rotation of the first propeller.

27. A watercraft drive in accordance with claim 1 wherein said motor is an electric motor having a rotor and a stator and further comprising,
a first support tube connected in heat conducting relationship to said rotor,
a second support tube having an inner surface connected in heat conducting relationship to said stator and an outer surface connected in heat conducting relationship to said underwater housing, means for connecting said shafts to said first support tube, a plurality of flanges connected in heat conducting relationship to said underwater housing, and bearing means operatively connected between said first support tube and said flanges, whereby heat from said rotor and stator is conducted to ambient water surrounding said underwater housing and shaft for cooling said motor.